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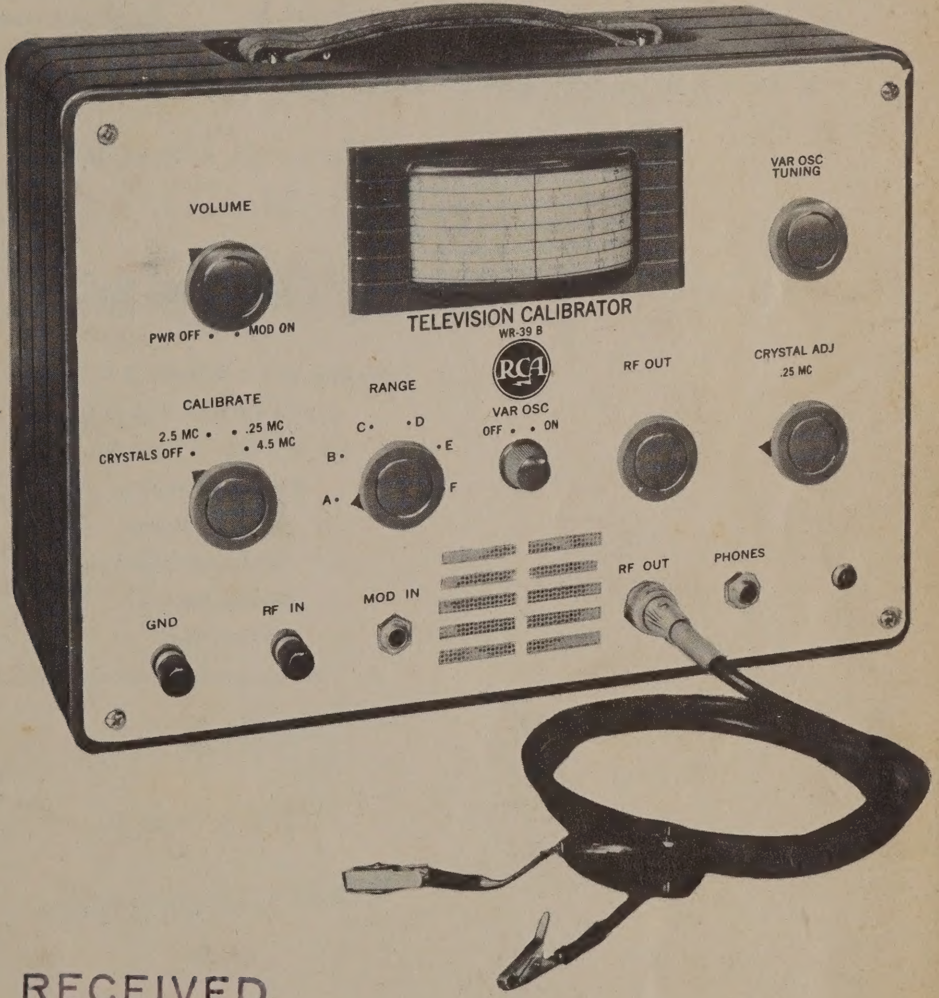
RCA TELEVISION CALIBRATOR

TYPE WR-39B



- Characteristics
- Operation
- Typical Uses
- Maintenance

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TEST AND MEASURING EQUIPMENT HARRISON, N. J.

Safety Precautions

High voltages are dangerous! Always observe the following precautions.

1. Do not work alone. Another person should be present to remove power and apply resuscitation in case of accident.

2. Avoid close proximity to high-voltage points. If you are unfamiliar with equipment, find out where the high-voltage points are located. Remember that high voltage may appear at unexpected points in defective equipment.

3. Do not connect ground lead of the WR-39B to a high-voltage point! The ground lead of the instrument is connected internally to the case.

Items Supplied with WR-39B

Tubes Supplied: 2 RCA-6J6, 2 RCA-6BH6,
1 RCA-6BE6,*1 RCA-6C4,
1 RCA-0A2, 1 RCA-6X4.
Warranty Certificate
Instruction Booklet
Rf Output Cable
Binding Posts (2)
Phone Plug*
*See notes on schematic diagram.

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Supplement No. I for Instruction Booklet No. IB-4039-3

TELEVISION CALIBRATOR WR-39B

All instruments except those with Code No. 1149 have the following changes in the Schematic Diagram, page 12-13 and in Replacement Parts List, page 14.

Schematic Diagram

Remove R39 and reconnect remaining leads to Terminal 7.

Replacement Parts List

Delete R39

On all instruments other than those with Code No. 1149 a weighted tube shield is supplied in the packing box. This is for installation on V-3, type 6AS6 tube.

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TELEVISION CALIBRATOR

Type WR-39B

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Specifications

Electrical:

Variable-Frequency Oscillator:

Frequency Range	
(on fundamentals)	19-110-Mc in 4 bands 170-240-Mc in 2 bands
(on harmonics)	38-220-Mc in 4 bands 340-480-Mc in 2 bands
Tuning Drive Ratio	10 to 1
Output Attenuation Range	From 100 to 1%
External Modulation Voltage (max.)	3 volts rms

(Into MOD IN jack which has a 5000-ohm input)

Crystal Oscillators

.25/4.5-Mc Stage—	
Accuracy	±0.03%
Output Voltage	at least 0.05 volt
2.5-Mc Stage—	
Accuracy	±0.01%

Internal Modulation Frequencies	0.25-Mc 4.5-Mc Audio

Internal Modulator:

Frequency Range	0-30 Mc
Voltage Required at "MOD IN" jack	10 max. volts

Audio Amplifier:

Power Output	0.3 max. watt
Frequency Response	peaked in mid-audio range

Power Supply:

Voltage	105-125 volts
Frequency	50/60 cycles
Power	30 watts
Fuse Protection	1.0 ampere

Tube Complement:

1 RCA-6J6	.25/4.5-Mc crystal oscillator
1 RCA-6BH6	clipper and modulator
1 RCA-6BE6	2.5-Mc crystal oscillator, detector
1 RCA-6BH6	1st audio amplifier
1 RCA-6C4	audio output
1 RCA-6J6	variable-frequency oscillator
1 RCA-0A2	voltage regulator
1 RCA-6X4	rectifier

Mechanical:

Dimensions:

Height	10 inches
Width	13.5 inches
Depth	7.5 inches
Weight (approx.)	16 lbs.
Finish	Blue-gray hammeroid case, anodized satin aluminum panels

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General Description

Designed primarily to be used with the RCA WR-59B Television Sweep Generator and a suitable oscilloscope to align television receivers, the WR-39B Television Calibrator is a generator of crystal-calibrated marker frequencies. In one compact, portable unit, the instrument combines the precision of crystal oscillators with the versatility of the variable-frequency oscillator. Included in this one instrument is a crystal-calibrated variable-frequency oscillator, two crystal-controlled oscillators with three crystal positions, a wide-band modulator stage for internally modulating the output at audio and rf frequencies, and an audio amplifier with internal speaker. An internal audio oscillator is provided to modulate the output of the variable-frequency oscillator, when required.

The variable-frequency oscillator, from which the marker signal is derived, can be tuned to any frequency within the commercial television bands. Frequency settings, and television picture and sound carriers are indicated on a large, easy-to-read drum dial. A miniature built-in loudspeaker facilitates zero beating the variable-frequency oscillator with any harmonic of either a 2.5-Mc crystal standard or a 0.25-Mc crystal standard included in the unit. Since all of the standard RMA frequencies used in television service (sound and picture carrier frequencies, sound and picture intermediate frequencies, and local-oscillator frequencies) are harmonics of .25-Mc, these frequencies can be rapidly identified with crystal accuracy by using the Television Calibrator to superimpose a marker on an oscillographic presentation of a response curve.

An internal 4.5-Mc crystal oscillator is also incorporated in the Television Calibrator. The output of this oscillator may be used to modulate the output of the variable-frequency oscillator to provide marker "pips" spaced 4.5-Mc on each side of the marker "pip" of the variable-frequency oscillator. These markers are especially useful in the alignment of rf amplifiers of television receivers. Similarly, a .25-Mc crystal oscillator is incorporated in the Television Calibrator to provide marker "pips" spaced .25-Mc from the frequency of the variable oscillator. These marker "pips" are especially useful in determining the characteristics of the response curve of discriminators and ratio detectors. The 4.5-Mc output may be used by itself with or without modulation for alignment of television receivers employing intercarrier sound.

In addition to its primary function as a marker generator, the Calibrator can also be used to identify unknown frequencies falling within the frequency range of the instrument; it can be used as a crystal-calibrated variable-frequency oscillator, either modulated or unmodulated, for adjusting traps, aligning FM receivers, calibrating other signal generators, and adjusting the frequencies of small transmitters. It may also be used in combination with the internal .25-Mc oscillator to provide a bar pattern on the face of the kinescope of a television receiver so that linearity adjustments may be made on all channels whether or not a television station is on the air. The WR-39B may also be used as a "miniature" television transmitter to provide a signal on the face of the kinescope when an external video signal source is available.

To enable the serviceman to identify the frequencies of very weak signals, a phone jack is provided on the front panel. A jack is also provided for the introduction of an external modulating voltage of any frequency when modulation of the output frequency of the variable-frequency oscillator is desired. Supplied complete with power cord, and shielded output cable, the instrument is enclosed in a sturdy, well-shielded steel case finished in attractive blue-gray hammeroid with anodized satin-aluminum panels.

Functions of Controls

VAR OSC TUNING—This control tunes the variable-frequency oscillator to the frequency shown on the dial scale. Sound and picture carriers for all television channels are clearly marked on the dial.

RF OUT—As the control is turned clockwise, the voltage output of the oscillator is increased.

CRYSTAL ADJ—This control tunes the .25-Mc crystal oscillator over a very narrow band of frequencies. It is used to adjust the output frequency of the tenth harmonic of the .25-Mc crystal oscillator to zero-beat with the 2.5-Mc crystal-oscillator output.

VOLUME—This control, when in its extreme counterclockwise position, turns the equipment off. As the control is rotated clockwise, the instrument is turned on, and the volume of the sound in the speaker (and phones, if they are used) is raised. When this control is in its extreme clockwise position (MOD ON) the output of the variable oscillator or 4.5-Mc crystal oscillator is modulated by an internally generated audio frequency. (See notes on schematic diagram.)

CALIBRATE—When this control is in the "CRYSTAL OFF" position, the crystal oscillators are inoperative, but the variable-frequency oscillator is operative (providing VAR OSC switch is not in the "OFF" position), and its output is available at the RF OUT jack. When the control is set on "2.5 MC", a 2.5-Mc crystal oscillator is turned on in addition to the variable-frequency oscillator. When the control is set on ".25 MC", a .25-Mc crystal oscillator is turned on in addition to the variable-frequency oscillator and the 2.5-Mc crystal oscillator. In this position the output frequency of the variable oscillator is modulated by a .25-Mc wave. When the control is set to "4.5 MC", the output frequency of the variable oscillator is modulated by a 4.5-Mc wave.

RANGE—This control selects the frequency range covered by the variable-frequency oscillator.

VAR OSC—This switch applies or disconnects the plate voltage to the variable-frequency oscillator making it operative in the "ON" position and inoperative in the "OFF" position. When this switch is in the "OFF" position and the CALIBRATE control is set to "4.5 MC", the output of the 4.5-Mc crystal oscillator alone is applied to the RF OUTPUT jack. Either the output of the VFO or the 4.5-Mc crystal oscillator can be amplitude modulated internally by turning the VOLUME control to its MOD ON position.

RF OUT—The modulated or unmodulated output of the variable-frequency oscillator and/or the .25/4.5-Mc crystal oscillator appears at this jack.

RF IN—An external rf signal may be applied to this jack when the instrument is used as a heterodyne frequency meter.

PHONES—Phones may be plugged into this jack to supplement the front-panel speaker when beat notes of very low volume must be heard.

MOD IN—Any external frequency may be applied at the MOD IN jack to modulate the output frequency of the variable-frequency oscillator. The external signal at the RF OUT JACK will be modulated and can be used to provide additional marker "pips". (See notes on schematic diagram.)

GND—This terminal connects the instrument chassis and serves as a common return for all equipment used with the unit.

Operation

To prepare the instrument for operation, connect the power cord at the rear of the instrument to an ac outlet supplying 105-125 volts, 50-60 cycles. Connect the output cable to the RF OUT jack. Rotate the VOLUME control clockwise to turn the instrument on, and allow a few minutes for the equipment to reach a stable operating temperature.

Turn the VAR OSC switch to "OFF", and the CALIBRATE selector to ".25 MC". Rotate the CRYSTAL ADJ control through its range while listening to the sound in the speaker. The VOLUME control should not be in the "MOD ON" position during this operation. A very low-frequency note should be heard. This low-frequency note is the difference in frequency between that of the 2.5-Mc crystal standard and that of the tenth harmonic of the .25-Mc crystal oscillator. To adjust the .25-Mc crystal frequency to exactly .25-Mc, set the CRYSTAL ADJ control to zero beat by positioning the control halfway between the two positions where the low-frequency note just disappears. A more accurate adjustment is possible if a headset is used. The instrument is now ready for use, either as a generator of marker frequencies or as a heterodyne frequency meter.

Setting the Variable-Frequency Oscillator—The vf oscillator will usually be set on some harmonic of .25-Mc for most television service use. It will be helpful to consider an example. Suppose a marker is desired to establish the location of the channel 6 picture carrier on an oscilloscope trace. The frequency of this carrier is 83.25-Mc. Set the RANGE switch on "D", and the CALIBRATE switch on "2.5 MC". As the TUNING control is rotated over the band, beat notes will be heard every 2.5-Mc. In particular, a beat will be heard at 82.5-Mc and also at 85-Mc, one on each side of the wanted frequency. Set the TUNING control exactly on zero beat with the beat that occurs near 82.5-Mc, indicating that the marker is oscillating at exactly 82.5-Mc, even though the dial scale does not read exactly this value. Set the CALIBRATE switch on ".25 MC", then *slowly* turn the TUNING control toward a higher frequency. A beat will be heard every .25-Mc, and since 83.25-Mc is .75-Mc higher than 82.5-Mc, the third beat from the 82.5-Mc point on the dial scale will be 83.25. A little practice in this procedure will enable a television serviceman to set the main oscillator exactly on a harmonic of .25-Mc with a minimum of time and effort.

Applications

General Application—To align a television receiver, or any other receiver or device employing wide-band circuits, a visual indication of the response of the circuit being aligned is required if the alignment is to be considered acceptable. Visual alignment, fast replacing the older, slower point-by-point alignment procedure, is as rapid as it is effective, and when combined with the use of accurately established marker frequencies, it is precise.

The usual test set-up for making a visual alignment is shown in Figure 1. If the amplifier under test happens to be a wide-band intermediate-frequency amplifier, then the sweep generator is normally connected first to the grid of the stage preceding the second detector.

The vertical-input terminals of the oscilloscope are connected across the detector load resistor; the horizontal terminals are connected to a source of deflection voltage usually supplied by the sweep generator. When the sweep generator is tuned to sweep the band of frequencies accepted by the if circuit, a trace representing the response characteristics of the circuit will appear on the oscilloscope screen. A typical trace is shown in Figure 2A. From this trace, valuable information about the response can be obtained, but if the center frequency of the response, and its band-

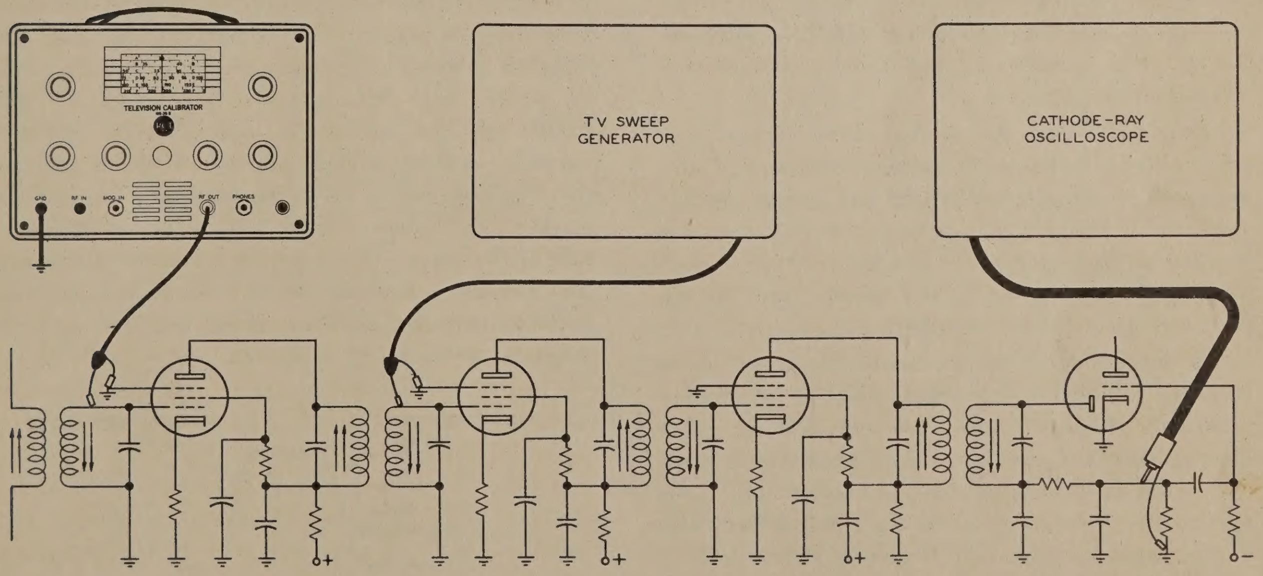


Figure 1. Typical Visual Alignment Setup

width, are to be determined to any degree of accuracy, a marker must be used. When a source of marker frequencies—the Television Calibrator—is coupled to the input of the amplifier under test, a discontinuity, or "pip", will be observed on the trace, as illustrated in Figure 2B. If the marker generator is tuned exactly to the center of the pass band accepted by the intermediate-frequency amplifier, then this marker "pip" will indicate the position of that frequency on the trace. Knowing the center frequency, the serviceman then adjusts the final tuned circuit for a trace that is of maximum amplitude, and is symmetrical about the marker "pip", or has the shape recommended by the manufacturer of the equipment being aligned.

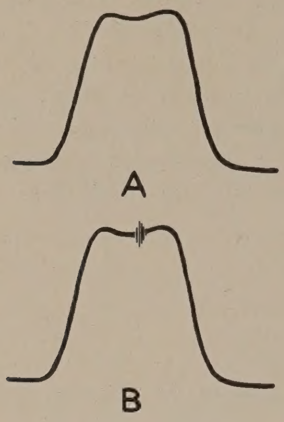
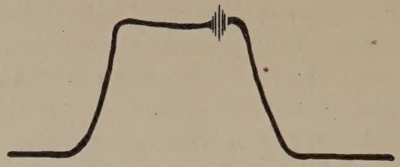


Figure 2. Tuned Circuit Response

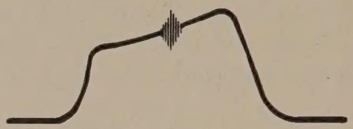
Preceding stages are then adjusted progressively by moving the sweep generator output cable back, stage-by-stage, toward the input of the amplifier while adjusting, stage-by-stage, the individual interstage coupling transformers.

Figure 3 illustrates the position of the marker "pip" relative to the response for various conditions of misalignment. It must be emphasized that once the marker generator is tuned to the correct frequency, it is the position of the response which is incorrect, and which must be moved over under the marker "pip" by adjustments of the tuned circuits in the amplifier.

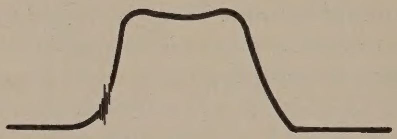
The determination of the bandwidth of particular response is another important function of marker generators. Figure 4 shows how this is done. After the amplifier is aligned, the marker generator is tuned to a lower frequency, so that the marker "pip" falls on the 70% response point on the low-frequency side of the response curve. The frequency at this point is read from the marker-generator dial scale, then the generator is tuned toward a higher frequency until the marker "pip" rests on the high-frequency side of the curve at the 70% response point. This frequency is also read from the dial scale. The difference between the two frequencies is equal to the bandwidth of the amplifier at the 70% response points.



RESPONSE GOOD, BUT
RESONANT FREQUENCY OF
TUNED CIRCUIT A LITTLE LOW



RESONANT FREQUENCY OF
TUNED CIRCUIT CORRECT, BUT
RESPONSE NOT SYMMETRICAL



RESPONSE GOOD, BUT
RESONANT FREQUENCY
OF TUNED CIRCUIT TOO HIGH

Figure 3. Improperly Aligned Tuned Circuits

Bandwidth of a response curve may be determined in another manner with the use of an external variable-frequency oscillator. The output frequency of the WR-39B Television Calibrator should be tuned so that its marker "pip" falls on the 70% point on one side of the response curve. The output of the external variable oscillator is fed into the MOD IN jack of the WR-39B and tuned to the frequency at which a marker "pip" appears at the 70% point on the other side of the curve. (See notes on schematic diagram.) The frequency as read on the dial of the external variable-frequency oscillator is the bandwidth of the response curve at 70% response.

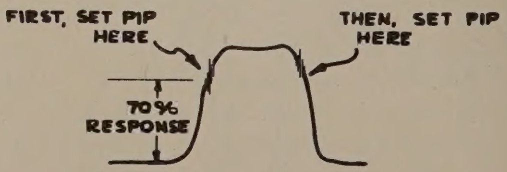


Figure 4. Bandwidth Measurement

The application of marker generators to alignment problems has been discussed in the foregoing paragraphs in a very general way to acquaint the reader with the technique.

Since various models of television receivers employ different coupling and amplifier circuits, any one method of alignment, if described completely in this book, would be of little value of the television serviceman. In all cases, before alignment of any television receiver is attempted, the manufacturer's alignment instructions should be consulted. However, since the application of the Television Calibrator to alignment techniques is in all cases simply and clearly indicated, its use can be described in sufficient detail to cover all methods of alignment. Accordingly, the following applications will proceed with the assumption that the other equipment required is set up and operated in conformance with the manufacturer's instructions pertaining to the particular receiver under test, and according to standard visual alignment technique.

Aligning Picture-IF Amplifiers—The test equipment and the receiver are set up as shown in Figure 5. When the sweep generator (RCA Television Sweep Generator or equivalent unit) is tuned to sweep the pass band of the picture if amplifier, a trace similar to that of Figure 6 should appear on the oscilloscope screen. This trace is typical of the picture if response of modern television receivers. Since the intermediate frequencies for most television receivers are 25.75-Mc for picture and 21.25-Mc for sound, these frequencies are shown in their proper positions in Figure 6.

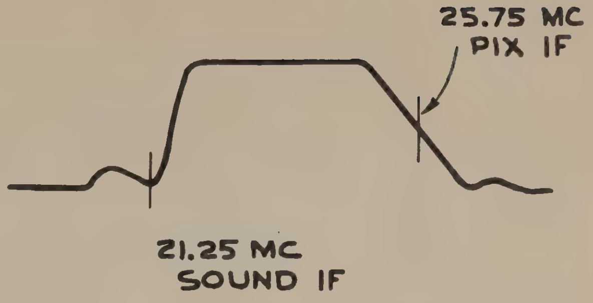


Figure 6. Picture-IF Response

Some television receivers, particularly pre-war receivers, use different intermediate frequencies. In this case, the manufacturer's alignment instructions should be consulted to determine the frequencies used, then the sweep generator is tuned to sweep the proper frequency band.

During the alignment of the picture-if amplifier, it is ncessary to know the positions of various frequencies along the response curve. These frequencies are caused to appear as marker "pips" on the response curve. If the television receiver employs the standard RMA intermediate frequencies, then the marker frequencies may be obtained directly from the Television Calibrator. If the intermediate frequencies are below 19-Mc (some receivers employ a

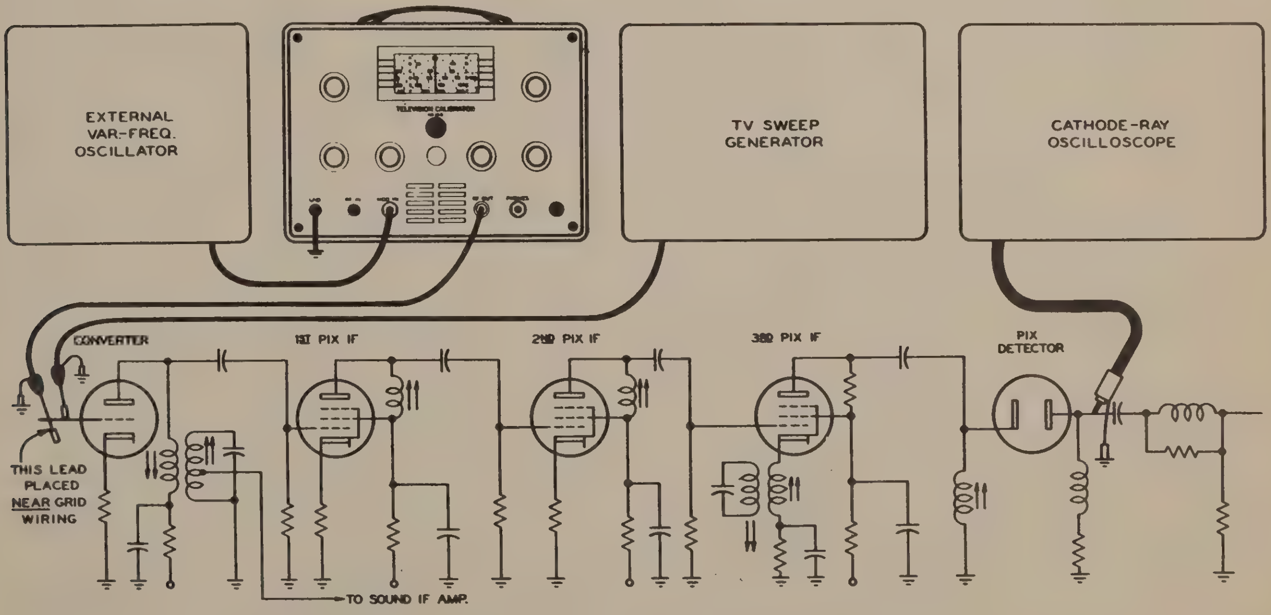


Figure 5. Picture-IF Amplifier Alignment

picture if of 12.75-Mc and a sound if of 8.25-Mc), then the Television Calibrator is tuned to the carrier frequency of any television channel; the receiver is tuned to the same channel, and the Television Calibrator output is fed in at the receiver antenna terminals. The signal from the Television Calibrator, when heterodyned with the receiver's local oscillator, produces the desired if marker frequency. When this method is used, the receiver oscillator must first be set exactly on the correct frequency as described in a following paragraph on local-oscillator alignment.

The following description will asume that the receiver under test employs standard RMA intermediate frequencies, although under no circumstances does this assumption mean that receivers utilizing other intermediate frequencies cannot be aligned easily with the Television Calibrator.

The instrument is employed as follows:

1. Couple the output cable of the Television Calibrator loosely to the input of the mixer tube (refer to Figure 5). Sufficient coupling is usually obtained when the ground lead on the output cable is connected to the receiver chassis and the "hot" lead is placed near the wiring of the mixer stage. Some television receivers, having comparatively low-gain if amplifiers may require tighter coupling. Too much coupling is undesirable, as detuning of the circuit may result. If the curve shape is altered when the marker signal is inserted, coupling is too tight.

2. Set the Television Calibrator frequency exactly on 25.75-Mc as described under "Operation". A marker "pip" should appear somewhere on the trace. If the oscilloscope used to observe the response curve has a wide-band video amplifier, the combination of marker "pip" and response curve may look like the curve shown in Figure 7A. A sharper marker "pip" may be obtained when the high-frequency response of the oscilloscope vertical amplifier is decreased by shunting the vertical input terminals with a small capacitor (about .001 μfd.). The resulting trace is shown in Figure 7B.

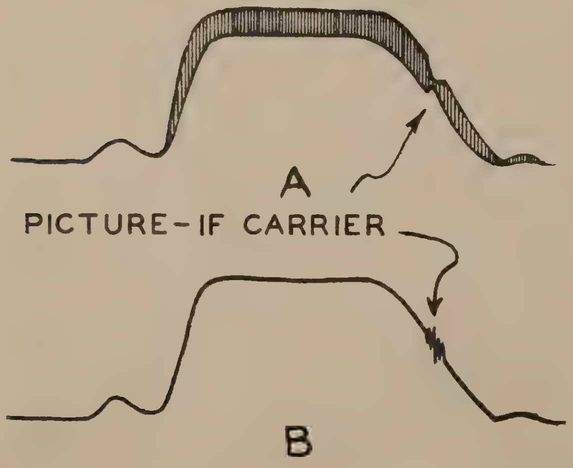


Figure 7. Picture-IF Response

3. The position of the 25.75-Mc marker (picture-if carrier) should be at approximately the 50% response point on the slope of the response curve, as shown in Figure 7. The tuned circuits in the picture-if amplifier are adjusted so that the response curve is of the proper shape with the marker "pip" in the position shown in Figure 7.

4. The position of any frequency on the response curve can be determined by placing the marker "pip" at that point and reading the frequency from the tuning dial scale. One important frequency is that where the response just starts to drop off toward the sound-carrier frequency (see Figure 8). If the variable-frequency oscillator of the WR-39B is set and calibrated to the picture-if carrier and the external variable-frequency oscillator is set to a frequency which is the difference between the picture-if carrier and the frequency whose marker "pip" is shown in Figure 8, two simultaneous markers will appear. These frequencies are most important in the alignment of picture-if amplifiers and their marker "pips" may be kept in sight constantly to eliminate the necessity of retuning and recalibrating the signal source. Other important frequencies are the trap frequencies shown in Figure 9.

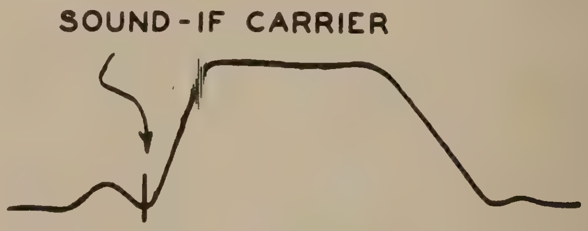


Figure 8. Picture-IF Response

Since the response of the amplifier is very low at the trap frequencies, the marker "pip" will disappear when it is placed on these frequencies; however, these points can be determined on the response curve by placing the marker "pip" first on one side of the trap frequency, then on the other, and interpolating the center frequency. During preliminary alignment when the response of the amplifier at the trap frequencies has not been tuned to a minimum, a marker can be placed on the adjacent channel sound if-carrier or adjacent channel picture if-carrier. These markers can be obtained from a separate variable-frequency

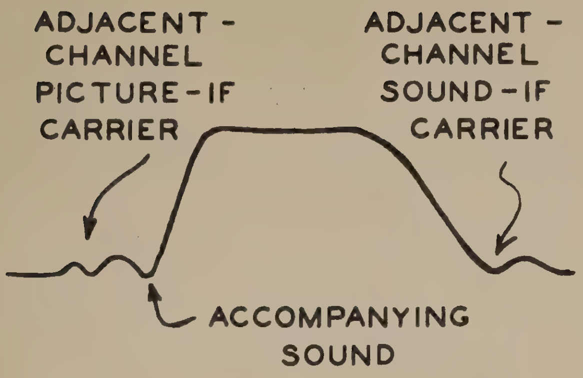

ADJACENT - CHANNEL PICTURE - IF CARRIER
ADJACENT - CHANNEL SOUND - IF CARRIER
ACCOMPANYING SOUND

Figure 9. Trap Frequencies

oscillator tuned to 1500 kc and connected to the MOD IN jack of the WR-39B. (See notes on schematic diagram.) With the vfo of the WR-39B set for a main marker at the sound or picture if-carrier frequency, markers will appear 1.5-Mc away from the main marker. Two simultaneous marker "pips" may be provided by the WR-39B, one at the sound-if carrier and the other at the picture-if carrier when the output of the variable-frequency oscillator is tuned to either frequency and the 4.5-Mc crystal-oscillator output is used to modulate it. This may be accomplished by turning the CALIBRATE selector to "4.5 MC". It is advisable to maintain the RF OUT control near its maximum clockwise position whenever internal modulation is employed. If the marker amplitude is still too high, it may be reduced by looser coupling to the amplifier input point. The size of the marker "pip" can be increased by turning the RF OUT control clockwise, or by coupling the output cable closer to the amplifier under test, or both. Coupling which is too tight, however, may result in detuning of the if amplifier and consequent distortion of the response.

Traps in the picture-if amplifier are adjusted by feeding the output of the Television Calibrator, tuned to the trap frequency, into the if amplifier. Each trap is adjusted for minimum output as indicated by a sensitive vacuum-tube voltmeter connected across the second-detector load resistor. If the output of Television Calibrator is modulated by the internal audio signal, an oscilloscope or the highly sensitive RCA Audio Voltmeter WV-73A may be used as an output indicator.

The general procedure in aligning picture-if amplifiers is first to set the traps and then to align the other circuits in the if-amplifier. Since any adjustment made on these other circuits will in most cases slightly detune the traps, they may have to be "touched up" during the picture-if amplifier alignment. The manufacturer's alignment instructions will again determine the exact procedure to follow.

Aligning RF Amplifiers—The radio-frequency stages of a television receiver should have a pass band of about 6-Mc (Figure 10). The equipment for producing this is set up and operated according to the manufacturer's alignment instructions, and the output of the Television Calibrator is fed into the receiver antenna terminals. Normally, the Television Calibrator is tuned to the center frequency of the channel being aligned, then the tuning adjustments in the rf amplifier are adjusted to produce a response which is symmetrical on each side of the marker "pip".

The output frequency of the calibrator is tuned to either the picture or sound carriers. When either of these frequencies is correctly marked on the rf response curve as seen on the oscilloscope, a marker "pip" appears at the other part of the curve if the output frequency is modulated by 4.5 megacycles. To do this, the CALIBRATE selector is set at "4.5 MC" position and two marker "pips", one marking the sound carrier and the other marking the picture carrier are seen on the response curve and are spaced exactly 4.5 megacycles apart.

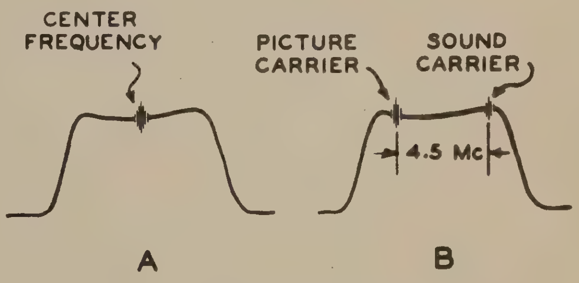


Figure 10. RF Response

Aligning RF Oscillators—The local oscillator in the television receiver can be rapidly and efficiently aligned by feeding the sound-carrier frequency into the input of the receiver and adjusting the receiver oscillator to obtain zero output from the sound discriminator. *This procedure can be followed only after the sound-if system has been correctly aligned.* The procedure follows:

1. Couple the output of the Television Calibrator to the input of the receiver.
2. Connect a VoltOhmyst Electronic Meter*, or equivalent zero-center voltmeter, to the output of

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*Trade Mark "VoltOhmyst" Reg. U.S. Pat. Off.

(Continued on Page 16)

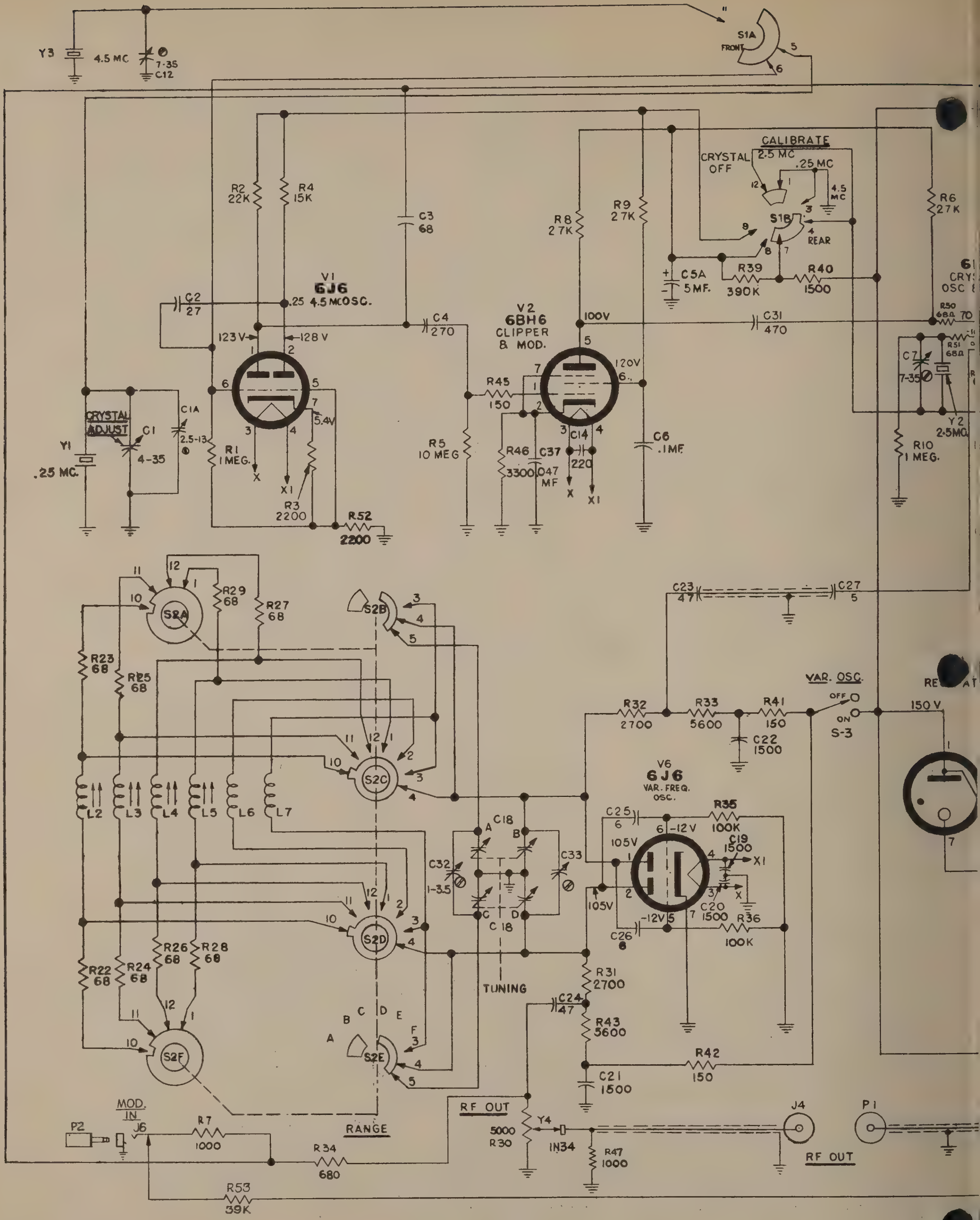
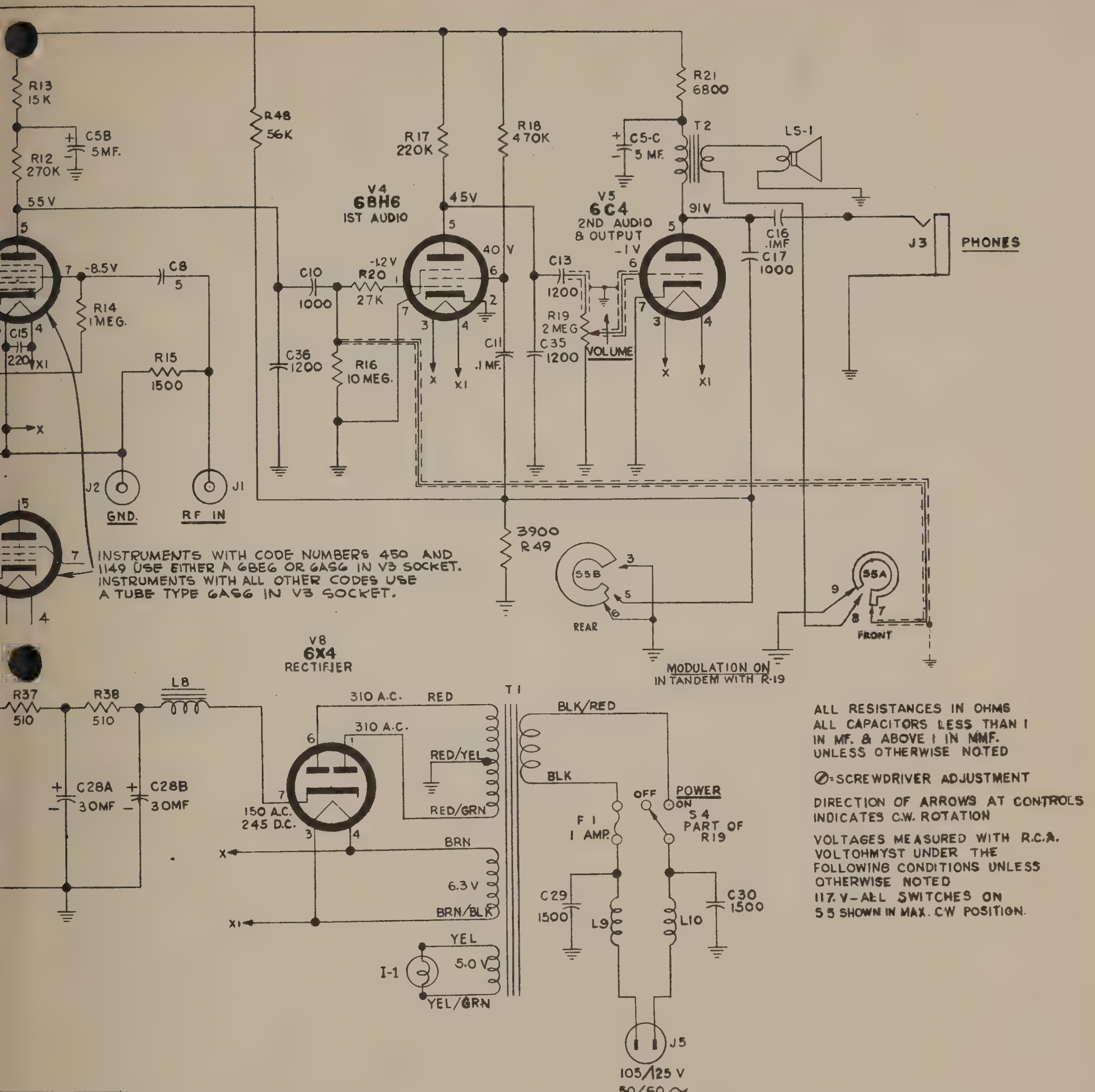

Y3
4.5 MC
7-35
C12
S1A
FRONT
5
6
R2
22K
R4
15K
C3
68
V1
6J6
4.5 MC OSC.
C2
27
123V
128 V
C4
270
V2
6BH6
CLIPPER
& MOD.
100V
120V
R8
27K
R9
27K
CALIBRATE
CRYSTAL
OFF
2.5 MC
.25 MC
4.5 MC
S1B
REAR
C5A
5 MF.
R39
390K
R40
1500
C31
470
R6
27K
CRYSTAL ADJUST
C1
4-35
C1A
2.5-13
Y1
.25 MC.
R1
1 MEG.
5.4V
R3
2200
R52
2200
R5
10 MEG
R45
150
R46
3300
C37
.047 MF
C14
220
C6
.1 MF.
R50
68Ω
R51
68Ω
C7
7-35
Y2
2.5MC
R10
1 MEG.
S2A
R29
68
R27
68
S2B
R23
68
R25
68
S2C
L2
L3
L4
L5
L6
L7
C18
C32
1-3.5
C33
S2D
R26
68
R28
68
R22
68
R24
68
S2F
S2E
A B C D E F
TUNING
RANGE
C23
47
C27
5
R32
2700
R33
5600
R41
150
C22
1500
VAR. OSC.
OFF
ON
S-3
150 V
V6
6J6
VAR. FREQ. OSC.
C25
6
R35
100K
C19
1500
-12V
105V
C20
1500
R36
100K
C26
6
R31
2700
C24
47
R43
5600
R42
150
C21
1500
MOD. IN
P2
J6
R7
1000
R34
680
R53
39K
RF OUT
5000
R30
Y4
1N34
R47
1000
J4
P1
RF OUT

Figure 1A.



INSTRUMENTS WITH CODE NUMBERS 450 AND 1149 USE EITHER A 6BE6 OR 6AS6 IN V3 SOCKET. INSTRUMENTS WITH ALL OTHER CODES USE A TUBE TYPE 6AS6 IN V3 SOCKET.

ALL RESISTANCES IN OHMS
ALL CAPACITORS LESS THAN 1 IN MF. & ABOVE 1 IN MMF. UNLESS OTHERWISE NOTED

⊘=SCREWDRIVER ADJUSTMENT

DIRECTION OF ARROWS AT CONTROLS INDICATES C.W. ROTATION

VOLTAGES MEASURED WITH R.C.A. VOLTOHMYST UNDER THE FOLLOWING CONDITIONS UNLESS OTHERWISE NOTED
117 V-ALL SWITCHES ON
S5 SHOWN IN MAX. C.W. POSITION.

NOTE 1: R53 is omitted and J6 is an open circuit jack on instruments with code numbers 450 and 1149.

NOTE 2: On all instruments, except those with code numbers 450 and 1149, phone plug P2 must be inserted in Mod IN jack (J6) when the vfo is modulated. A higher rf output voltage can be obtained by removing the phone plug when the vfo is not modulated.

Replacement Parts List

Type WR-39B

Television Calibrator

When ordering Replacement Parts, please state Serial Number and Code Number of Instrument.

Symbol No.	Description	Stock No.
	Capacitors, Fixed and Variable	
C 1	Variable, ceramic, 3.7 to 35.2 μμf	59074
C 1 A	Trimmer, ceramic, 2.5 to 13 μμf	58733
C 2	Fixed mica, 27 μμf ± 10%, 500 volts	68757
C 3	Fixed mica, 68 μμf ± 10%, 500 volts	39624
C 4	Fixed mica, 270 μμf ± 10%, 500 volts	39638
C 5 A, B, C	Electrolytic, 5-5-5 μf − 10% + 40%, 350 volts	34890
C 6	Paper tubular, 0.1 μf ± 20%, 200 volts	73784
C 7	Variable, 7-35 μμf	45415
C 8	Ceramic, insulated, 5 μμf ± 10%, 500 volts	55513
C 10	Fixed mica, 1000 μμf ± 10%, 500 volts	39652
C 11	Same as C 6	—
C 12	Trimmer, variable, 7-35 μμf	45415
C 13	Fixed mica, 1200 μμf ± 10%, 300 volts	39654
C 14, 15	Fixed mica, 220 μμf ± 20%, 500 volts	39636
C 16	Same as C 6	—
C 17	Same as C 10	—
C 18 A, B, C, D	Variable, 4 sections: A & C, 0-51.5 μμf; B & D, 0-8.0 μμf	57693
C 19, 20, 21, 22	High "K" Type 1500 μμf ± 20%, 350 volts	55299
C 23, 24	Fixed mica, 47 μμf ± 5%, 500 volts	39620
C 25, 26	Fixed ceramic, 6 μμf ± 5%	55322
C 27	Same as C 8	—
C 28 A, B	Electrolytic, 30-30 μf − 10% + 100%, 300 volts	59429
C 29, 30	Same as C 19	—
C 31	Fixed mica, 470 μμf ± 10%, 500 volts	54003
C 32	Trimmer, ceramic, 1-3.5 μμf	55514
C 35, 36	Same as C 13	—
C 37	Paper tubular, 0.047 μf ± 10%, 200 volts	73558
	Fuse and Lamp	
F 1	Fuse, cartridge, glass body, 1 amp	3748
I 1	Lamp, pilot, 6-8 volt	11891
	Jacks and Connectors	
J 1	Pin jack (red)	55238
J 2	Pin jack (blue)	55239
J 3	Phone jack, open circuit output type	11780
J 4	Chassis connector, output	54695
J 6	Phone jack, closed circuit type*	7903
	Inductors	
L 1	Coil, oscillator, 2.5 MC	55506
L 2	Coil, oscillator	59070
L 3	Coil, oscillator	59071
L 4	Coil, oscillator	59072
L 5	Coil, oscillator	59073
L 8	Reactor, filter, 50/60 cycles	54701
	Plug	
P 2	Phone plug	54370
	Speaker	
LS 2	2″ x 3″ (PM)	57361
	Resistors, Fixed and Variable	
R 1	Fixed composition, 1 meg. ± 10%, ½ watt	30652
R 2	Fixed composition, 22,000 ohms ± 5%, ½ watt	30492
R 3	Fixed composition, 2200 ohms ± 10%, ½ watt	34767
R 4	Fixed composition, 15,000 ohms ± 10%, ½ watt	36714
R 5	Fixed composition, 10 meg. ± 10%, ½ watt	30992
R-6	Fixed composition, 27,000 ohms ± 10%, ½ watt	30409
R 7	Fixed composition, 1000 ohms ±10%	34766
R 8, 9	Same as R 6	—
R 10	Same as R 1	—
R 11	Fixed composition, 68 ohms ± 10%, ½ watt	34763
R 12	Fixed composition, 270,000 ohms ± 10%, ½ watt	30651
R 13	Same as R 4	—
R 14	Same as R 1	—
R 15	Fixed composition, 1500 ohms ± 10%. ½ watt	30654
R 16	Same as R 5	—
R 17	Fixed composition, 220,000 ohms ± 10%, ½ watt	14583
R-18	Fixed composition, 470,000 ohms ± 10%, ½ watt	30648
R 19, S 4	Variable, 2 meg. ± 20%	59075
R 20	Same as R 6	—
R 21	Fixed composition, 6800 ohms ± 10%, ½ watt	14659
R 22 to R 29 Incl.	Same as R 11	—
R 30	Variable, 5000 ohms ± 10%	59421
R 31, 32	Fixed composition, 2700 ohms ± 5%, ½ watt	30730
R 33	Fixed composition, 5600 ohms ± 5%, ½ watt	12356
R 34	Fixed composition, 680 ohms ± 10%, ½ watt	12262
R 35, 36	Fixed composition, 100,000 ohms ± 5%, ½ watt	3252
R 37, 38	Fixed composition, 510 ohms ± 5%, 2 watt	59069
R 39	Fixed composition, 390,000 ohms ± 10%, ½ watt	11988
R 40	Same as R 15	—
R 41, 42	Fixed composition, 150 ohms ± 10%, ½ watt	30880
R 43	Same as R 33	—
R 45	Same as R 41	—
R 46	Fixed composition, 3300 ohms ± 10%, ½ watt	30733
R 47	Same as R 7	—
R 48	Fixed composition, 56,000 ohms ± 10%, ½ watt	30653
R 49	Fixed composition, 3900 ohms ± 10%, ½ watt	30694
R 50, 51	Same as R 11	—
R 52	Same as R 3	—
R 53	Fixed composition, 39,000 ohms ± 10%, ½ watt	71084

Symbol No.	Description	Stock No.
	Switches	
S 1	Rotary, 1 section, 4 position	59077
S 2	Rotary, 4 section, 6 position	55502
S 3	Insulated, SPDT	59081
S 4	Part of R 19	
S 5	Rotary, 1 section, 12 position	59076
	Transformers	
T 1	Power, 50/60 cycles	53476
T 2	Audio, 60 cycles	37806
	Crystals	
Y 1	Frequency determining crystal .25 MC	59040
Y 2	Frequency determining crystal 2.5 MC	56910
Y 3	Frequency determining crystal 4.5 MC	59041
Y 4	Rectifier, crystal, 1N34	54374
	Miscellaneous	
	Binding post (pin plug)	47062
	Cable, RF output 4 ft. length including co-axial connector and 2 clips	59343
	Clamp, crystal	59078
	Cord, dial drive—stocked in 250-ft. spools (22″ required for one instrument)	72953
	Drum, dial assembly	55504
	Escutcheon, plexiglass, clear	55230
	Gear, 12 teeth for flexible shaft assembly	71800
	Gear, rotary switch (18 teeth)	71801
	Handle, carrying	53704
	Holder, fuse	55316
	Indicator, pilot light	54660
	Knob, control or tuning (small)	53689
	Knob, control or tuning (large)	53683
	Lock, shaft	59079
	Nut, speed nut for escutcheon	72765
	Pointer, knob	53684
	Pulley, small dial cord pulley (idler)	32289
	Pulley, dial tuning pulley (driver)	55505
	Scale, dial	57694
	Shaft, flexible tuning, complete with bushing	55503
	Socket, 2 contact, mica filled phenolic, contacts for 0.125 dia. pin (crystal)	55516
	Socket, pilot light	57761
	Socket, miniature, mica filled, natural phenolic, 7 contact	54684
	Spring, drive cord tension	37347
	Spring, knob	14270
	Terminal, lead thru	59080
	Washer, "C" washer for dial pulley	31608

* Instruments with code numbers 1149 and 450 have an open circuit jack, Stock No. 11780.

the sound discriminator (across the discriminator load resistors).

3. Set the Television Calibrator to 215.75-Mc (channel 13 sound).
4. If the receiver has a fine-tuning control, this should be set at the center of its tuning range.
5. Adjust the channel 13 oscillator trimmer for zero output from the discriminator. Check this point by turning the trimmer through the correct setting. The discriminator output should be positive on one side of the proper adjustment and negative on the other.
6. Adjust the remaining channels in a similar manner. In each case, set the Calibrator to the appropriate sound-carrier frequency. Since the order of alignment may differ in receivers of different make, the manufacturer's instructions should be consulted before proceeding.

The rf oscillator can also be aligned by using the calibrator as a precision heterodyne frequency meter. In fact, this method should be used with receivers employing intercarrier sound systems because the method outlined in steps 1 to 6 above is not applicable.

With the heterodyne method, the signal from the oscillator in the receiver is fed to the WR-39B at the RF IN terminal by means of a single wire loosely coupled to the oscillator in the receiver. This signal is heterodyned against the vfo in the WR-39B, and the frequency of the receiver oscillator is then adjusted until the "zero beat" is obtained.

In television receivers where the sound if is higher than approximately 22-Mc and the local oscillator operates on the high side of the carrier, the oscillator frequency will be outside the frequency bands (19—110 and 170—240-Mc) of the WR-39B. In such cases the variable frequency oscillator of the WR-39B should be tuned to one-half or one-third of the oscillator frequency of the receiver, and the instrument operates on a harmonic of the vfo. For example, in aligning a receiver with a sound-if carrier of 31.25-Mc and with the oscillator on channel 6 operating at 119-Mc, the vfo is tuned to 59.5-Mc and its second harmonic is (119-Mc) heterodyned against the oscillator in the receiver.

Aligning Sound-IF Amplifiers—With the exception of the response curve shape, the application of the Television Calibrator to alignment of sound if channels follows the same general procedure given in the previous paragraphs on picture if channels. The alignment equipment is set up as shown in Figure 11. The if response, with the superimposed marker "pip" is shown in Figure 12 as being indicative of that to be expected from normal sound if amplifiers. The width of the pass band can be determined as described previously under "General Application". The usual discriminator characteristic is shown in Figure 13A. Figure 13B shows the usual discriminator response curve with the center frequency (sound-if) modulated by the .25-Mc crystal (CALIBRATE selector set at ".25 MC" position). Three simultaneous markers are provided by modulating the center frequency with the

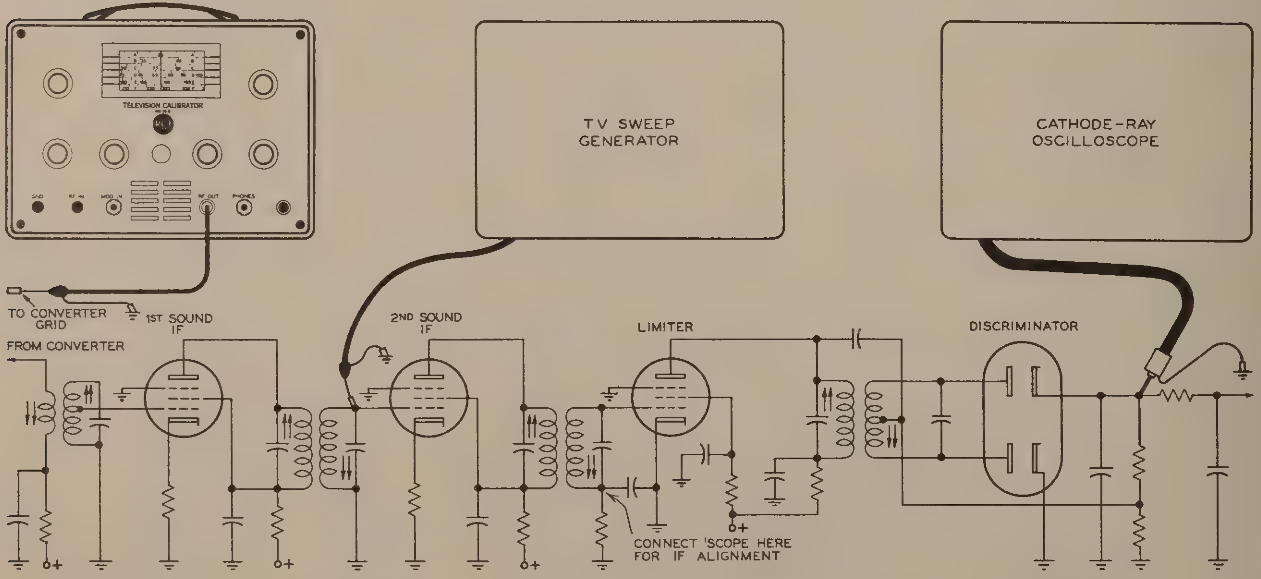


Figure 11. Sound-IF Amplifier Alignment

.25-Mc crystal-oscillator output. These marker "pips" are 250 kc apart and are used to check discriminator bandwidth. The center marker "pip" may not be visible since it is at a point of zero voltage and, consequently, the two visible "pips" will be 500 kc apart. If the small capacitor previously shunted across the oscilloscope vertical input is removed, a trace like that of Figure 14B will appear. Using this trace, the serviceman can determine the important center frequency of the discriminator characteristic with relative ease. Figure 15 illustrates various conditions of discriminator misalignment.

Another method of aligning the discriminator or ratio detector of television receivers is to obtain the usual response such as that shown in Figure 13A. The center frequency (sound-if) is then modulated by an audio frequency. An internal audio frequency is provided by placing the VOLUME control to the "MOD ON" position. (See notes on schematic diagram.) When the discriminator or ratio detector has been properly aligned, the response curve seen on the oscilloscope will be similar to that shown in Figure 13A. When the center frequency is other than that provided by the TELEVISION CALIBRATOR, the response curve will be similar to that in Figure 13C.

Television receivers employing intercarrier sound-if stages may be aligned in a manner similar to that described above. Since all receivers of this kind use a sound-if frequency of 4.5 megacycles, it is merely necessary to provide this frequency as the center frequency of the response curve. When the VAR OSC switch is set to the "OFF" position and the CALIBRATE selector is set to the "4.5 MC" position, the RF output frequency is 4.5 megacycles and its output may be controlled by the RF OUT Control. This output is fed into the video amplifier ahead of the 4.5-Mc take-off point. If additional markers are needed they can be obtained by connecting the output of an ordinary vf oscillator to the MOD IN jack. (See notes on schematic diagram.)

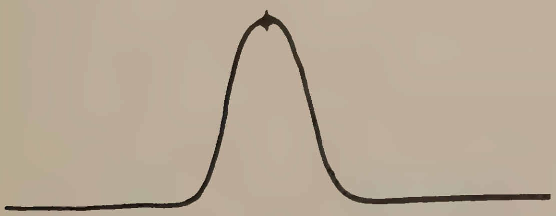


Figure 12. Sound-IF Response

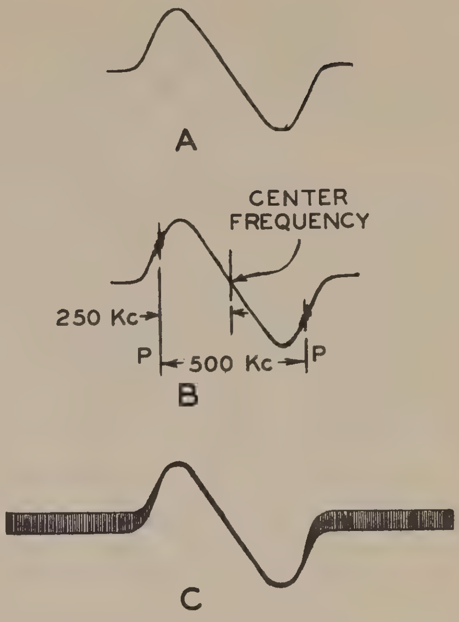


Figure 13. Discriminator Response

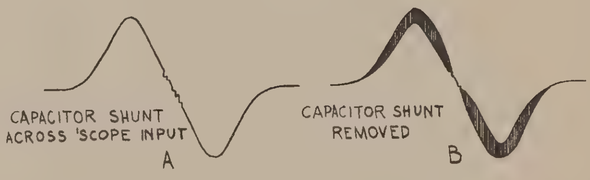
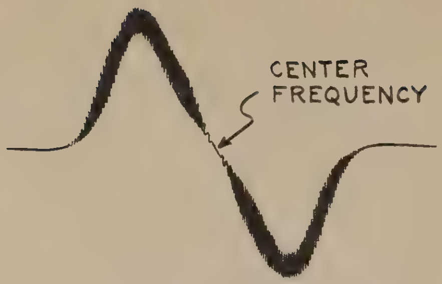


Figure 14. Discriminator Response

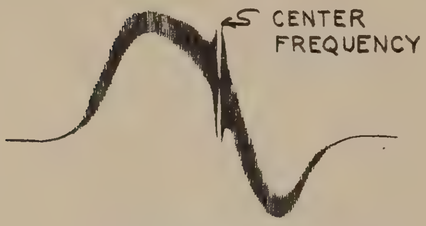
Second Detector and Video Amplifier Response Check—This test portrays on the screen of an oscilloscope a trace which shows the response of not only the video amplifier in a television receiver, but of the second detector and its load as well. Equipment for the test is set up according to Figure 16. The method follows:

1. Connect the outputs of the Television Calibrator and the sweep generator directly to the diode element not connected to the diode load (see Figure 16).

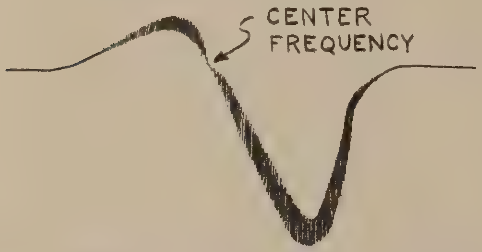
2. Set the sweep generator to sweep an arbitrary band of frequencies, say 20-30-Mc. Tune the Television Calibrator to 20-Mc. (These exact frequencies do not have to be used; it is only necessary to set



CORRECT RESPONSE



SECONDARY RESONANT FREQUENCY TOO HIGH



PRIMARY RESONANT FREQUENCY TOO HIGH, OR RESONANT FREQUENCIES OF PRECEDING IF TRANSFORMERS TOO HIGH

Figure 15. Improperly Aligned Discriminator

the Television Calibrator to a frequency which is included near the low-frequency end of the band swept by the sweep generator.) Rectification in the second detector will produce, across the detector load, a band of frequencies continuously swept from 0 to 10-Mc. This video sweep is used to check the video-amplifier response.

3. The detector probe of the oscilloscope is connected to the output of the video amplifier at the picture tube. If the oscilloscope is not equipped with a detector probe, then an external detector, using a diode or a crystal rectifier, may be utilized. The detector should have, in addition to good 60-cycle square-wave response, a low input capacitance to preclude any detrimental effect on the video-amplifier response produced by capacitance loading of the amplifier output. When the picture tube is removed from its socket, the amplifier can be tested under more nearly actual conditions, since the input capacitance of a well-designed detector closely approximates the input capacitance of the picture tube.

4. A trace similar to that shown in Figure 17 should appear on the screen of the oscilloscope. This trace represents the frequency-vs-amplification characteristic of the video amplifier and second detector. Particular frequencies along the response curve can be estimated, since the length of the entire trace is known to be representative of a video-frequency bandwidth equal to the sweep-width output of the sweep generator.

Adjusting Linearity—When the CALIBRATE switch of the WR-39B is set to .25-Mc, the rf output of the unit is modulated with a 250-kc signal. If this signal is received on a television receiver, a vertical bar pattern (approximately 16 bars) will be displayed on the kinescope. Thus, the WR-39B can be employed as a completely self-contained television signal simulator to check the operation of any television receiver on all channels. The vertical bar pattern will enable one to adjust the horizontal linearity of the receiver to a high degree of accuracy. If an externally generated audio signal of about 1200 cps is fed into the MOD IN jack, then 20 horizontal bars will be displayed on the television receiver kinescope, and vertical linearity can be adjusted. (See notes on schematic diagram.)

Checking Operation of Television Receiver on All Channels, When Only One Channel Is on the Air—The WR-39B Television Calibrator may be used as a signal source as shown in Figure 18 to provide a signal on all channels if an external video signal is available or if the CALIBRATE control is set to ".25 MC" position. Servicemen will find this feature of the WR-39B especially of value so that television receivers may be quickly and efficiently checked for proper operation on all channels even when only one channel is on the air. An external video signal is fed into the "MOD IN" jack on the WR-39B and the output of the Television Calibrator attached to the antenna terminals of the receiver. (See notes on schematic diagram.) Both the calibrator and receiver under test are tuned to the same picture carrier. A convenient video signal source may be obtained at the kinescope grid of a second receiver which is tuned to a channel on which a signal is being received. The video signal input at the MOD IN jack must be adjusted for the proper percentage of modulation by means of the contrast control on the receiver.

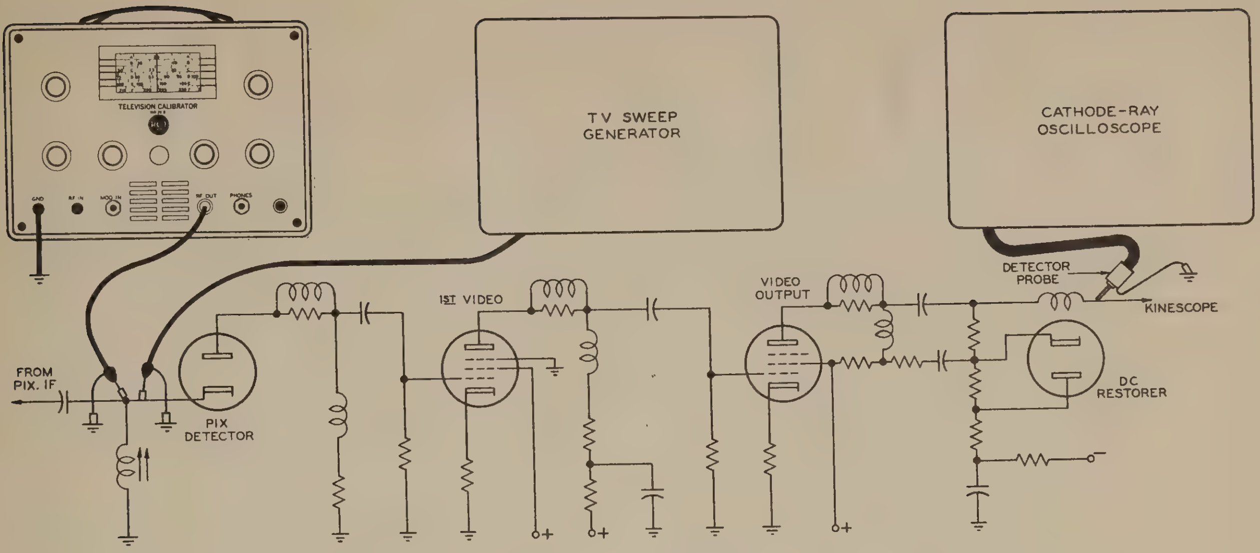


Figure 16. Second Detector and Video Amplifier Response Check

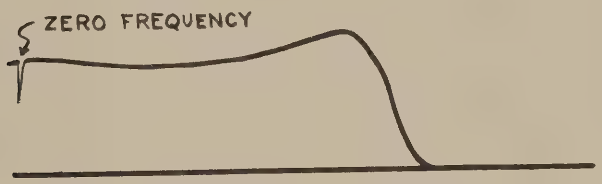


Figure 17. Video Amplifier and Second Detector Response

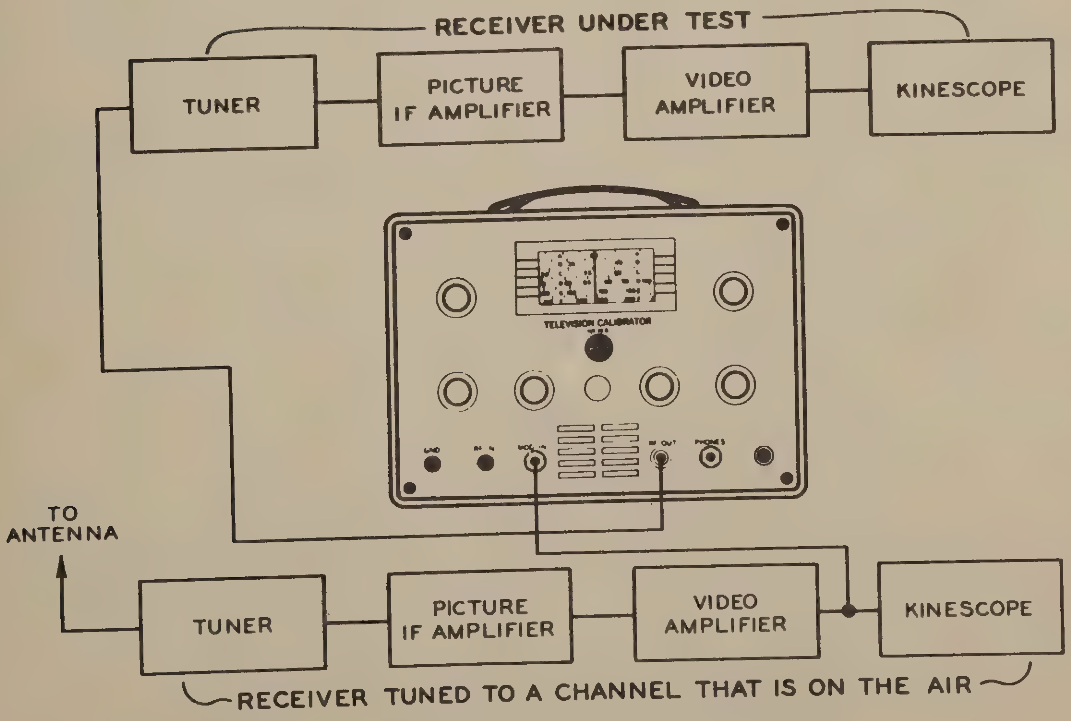


Figure 18. Setup As An All-Channel Transmitter

Circuit Description

A schematic diagram of the WR-39B Television Calibrator is shown in Figure 10A. The variable-frequency oscillator utilizes an RCA-6J6 in a push-pull circuit. Band selector is accomplished by a RANGE selector (S2) which connects separate inductances into the oscillator circuit for different positions of the selector, loads each inductance not in use with two 68-ohm resistors to minimize spurious resonances, and shunts the tuning capacitor (C18B and C18D) with another ganged variable capacitor (C18A and C18C) on bands A, B, C, and D. A portion of the rf output voltage when VAR OSC switch is in the proper position is coupled to the RF OUT JACK (J4) through the RF OUT control and a crystal modulator. Oscillator voltage is also fed to the cathode of the detector tube (V3). The variable-frequency oscillator output may be modulated by an internal audio frequency generated by the 1st and 2nd audio stages when the VOLUME control is set at "MOD ON" or by any external audio or rf voltage introduced into the MOD IN jack.

The 2.5-Mc crystal oscillator and detector circuit functions as a heterodyne detector when an external rf voltage is introduced at the RF IN post and as a crystal oscillator generating a 2.5-Mc signal with high-harmonic content. The harmonics of the 2.5-Mc crystal oscillator are heterodyned with the output of the variable frequency oscillator to form audible beats, which are fed to a conventional two stage audio amplifier (V4 and V5).

The 2.5-Mc crystal oscillator is operative in the "2.5 MC" and ".25 MC" positions of the CALIBRATE selector (S1). When this selector is on ".25 MC", a .25-Mc crystal is switched into the .25/4.5-Mc oscillator (V1). When this selector is on "4.5 MC", a 4.5-Mc crystal is switched into the .25/4.5-Mc oscillator. In either of these positions, the output of the .25/4.5-Mc oscillator modulates the output of the variable-frequency oscillator. The output of the .25/4.5-Mc crystal oscillator is fed to a clipper stage (V2) where deliberate distortion of the .25-Mc signal takes place. The output of the clipper, rich in harmonics, is applied to the detector screen grid to effect modulation of the 2.5-Mc signal. Since the 2.5-Mc signal and all of its harmonics are modulated by the .25-Mc signal and its harmonics, the 2.5-Mc harmonics will contain sidebands of .25-Mc, .5-Mc, .75-Mc, 1-Mc, 1.25-Mc, etc. In this way, even though high-order harmonics of the .25-Mc oscillator are too weak to be of any use, the .25-Mc sideband components of the 2.5-Mc oscillator harmonics are strong enough to generate audible beats, spaced .25-Mc apart, over the entire frequency range covered by the instrument.

External rf signals can be fed to the detector (V3) through the RF IN jack (J1) for comparison with either the crystal-oscillator frequency or the variable-oscillator frequency.

Plate and filament power requirements are supplied by the built-in power supply, which includes an RCA-6X4 rectifier (V8) and an RCA-0A2 voltage regulator (V7).

Maintenance

Caution: Disconnect the power supply cable before removing the instrument from the case to replace tubes or make service adjustments.

Tube Replacement—With proper care, the WR-39B should require little servicing other than possible replacement of tubes after long periods of service. The tubes may be made available for checking or replacement by removing the rear panel, or by removing the instrument from the case in the following manner:

1. Remove the four holding-screws from the bottom of the cabinet.
2. Remove the four front-panel screws.
3. Withdraw the unit from the case.

Fuse—A small 1.0-ampere cartridge fuse provides protection of the power supply system, and should not be short-circuited or replaced with one of higher rating. The fuse is located above the chassis and may be made accessible for replacement if the rear panel of the instrument is removed. Fuse failures should be carefully investigated before replacement since a fuse of good quality fails only under conditions of overload. The fuse clips should be kept clean and in secure contact with the fuse at all times.

Tube Socket Voltages—The normal voltages appearing at the respective tube-socket terminals with respect to chassis ground are shown in Figure 10A.

The voltage shown is indicative of the proper operating conditions of the circuit and should not vary in excess of ±20%. Circuit defects ordinarily will be found in cases of greater variation. The voltages shown in Figure 10A were measured with an RCA VoltOhmyst. Checks should be made with this instrument or a unit having similar characteristics. The nearest range above the voltage to be measured should be employed.

Dial Cord Replacement—A drawing of the dial-cord assembly is shown in Figure 19 to facilitate replacement of the unit if necessary.

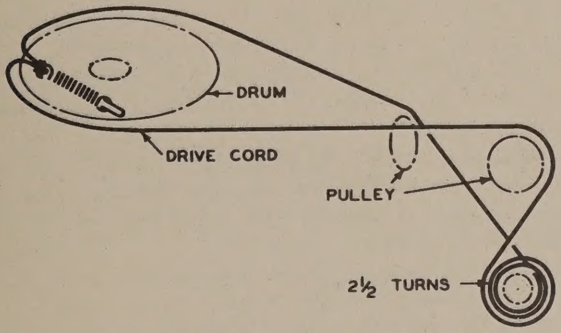


Figure 19. Pulley and Dial Cord Arrangement

Replacing Components—The utmost care has been taken in the design of this instrument to obtain a high degree of accuracy and stability. Its performance, like that of any other precision instrument, is dependent upon the rating and quality of its component parts. Therefore, if it becomes necessary to replace a part, the REPLACEMENT PARTS list in this booklet should be consulted for specifications. Only RCA Replacement Parts or other parts having identical characteristics should be used.

2.5-Mc Crystal Oscillator Adjustment—If the 2.5-Mc crystal standard is suspected of being slightly off frequency, it may be adjusted precisely as follows:

1. Obtain a communications receiver or a shortwave receiver, and tune it to WWV at 2.5, 5, 10, or 15 megacycles.

2. Remove the Television Calibrator from its case, turn the VAR OSC switch to its "OFF" position, and the CALIBRATE selector to "2.5 MC".

3. Couple one end of a wire loosely to the receiver antenna terminal; couple the other end loosely to the wiring around the socket of (V3).

4. Adjust C7 (see Figure 20 for location) until the beat with WWV is less than 250 cycles at 5-Mc, 500 cycles at 10-Mc, or 750 cycles at 15-Mc.

.25-Mc Crystal Oscillator Adjustment—If it is impossible to zero beat the .25-Mc crystal oscillator against the 2.5-Mc crystal oscillator within the range of the CRYSTAL ADJUST control, proceed as follows:

1. Remove the Television Calibrator from its case, turn the VAR OSC switch to its "OFF" position, and the CALIBRATE selector to ".25 MC".

2. Turn up the VOLUME control until an audible beat note is heard in the speaker.

3. Set the CRYSTAL ADJUST control at mid range, then adjust C1A (see Figure 20 for location) for zero beat.

4.5-Mc Crystal Oscillator Adjustment—Set the variable-frequency oscillator exactly on 22.5-Mc by beating the output of the variable-frequency oscillator with the output of the 2.5-Mc crystal oscillator. Turn the CALIBRATE selector to "4.5 MC" and adjust C12 for the lowest possible beat frequency.

2.5-Mc Oscillator Coil Adjustment—If, when the highest frequency band is in use and the CALIBRATE switch is on ".25 MC", the beats produced every .25-Mc are not of the same volume as the beats produced every .25-Mc, then L1 needs adjustment as follows:

1. Remove the instrument from its case, turn the VAR OSC switch to its "ON" position, and set the CALIBRATE selector on "2.5 MC".

2. Rotate the RANGE switch to "F" and set the TUNING control on a harmonic of 2.5-Mc, so that an audible beat is obtained.

3. Adjust L1 until the volume of the audible beat note is the same for either the ".25 MC" or "2.5 MC" positions of the CALIBRATE switch.

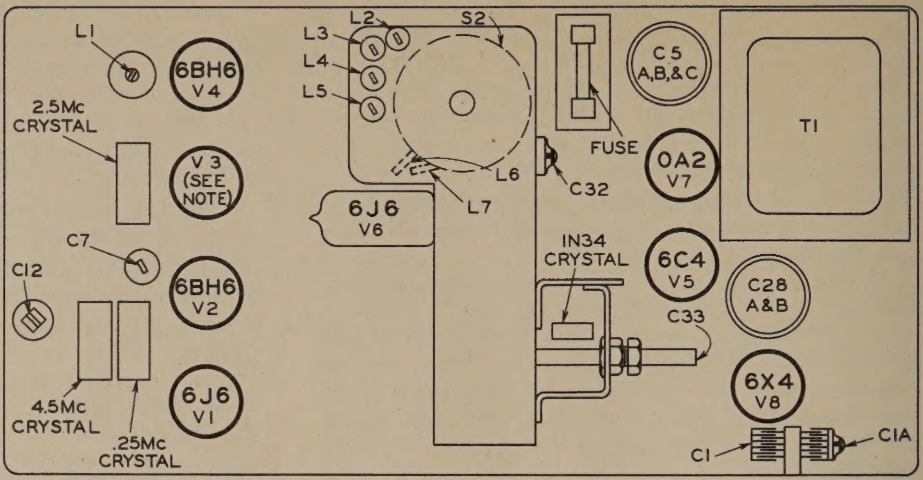
4. If the adjustment of L1 is changed, then C7 may have to be readjusted as explained previously under "2.5 MC" Crystal Oscillator Adjustment.

Replacing Oscillator Tube—When the oscillator tube (V6) is replaced, C33 can be readjusted to compensate for any difference in tube capacity. The adjustment is made as follows:

1. Remove the WR-39B from its case. Set the RF OUT control counter-clockwise and rotate the RANGE switch to "F".
2. Connect the output of a signal generator to the RF IN jack, and tune the generator to 200-Mc (a harmonic of a lower frequency may be used).
3. Set the CALIBRATE selector on "2.5 MC", and readjust the signal generator exactly to 200-Mc, as noted by a zero beat in the WR-39B speaker.
4. Set the CALIBRATE selector on "CRYSTAL OFF", turn the RF OUT control away from the counter-clockwise position, and set the TUNING control so that the 200-Mc mark on the dial scale is exactly under the indicator line.
5. Adjust C33 for zero beat (see Figure 20 for the location of C33).

Variable-Frequency Oscillator Adjustment—If, when the CALIBRATE selector is on "2.5 MC", the audible beat notes do not occur near dial-scale marks representing harmonics of 2.5-Mc, the variable-frequency oscillator may need alignment. Alignment is best accomplished in the following manner:

1. Remove the Television Calibrator from its case. Set the RF OUT control counter-clockwise, and rotate the RANGE switch to "F".



NOTE: 6BE6 OR 6AS6

Figure 20. Tube and Adjustment Locations

2. Connect the output of a signal generator to the RF IN jack, and tune the generator to 200-Mc (a harmonic of a lower frequency may be used to obtain a frequency of 200-Mc).

3. Set the CALIBRATE selector to "2.5 MC", and readjust the signal generator exactly to 200-Mc, as noted by a zero beat in the speaker.

4. Set the CALIBRATE selector to "CRYSTAL OFF", turn the RF OUT control away from the counter-clockwise position, then adjust the TUNING control for zero beat with the signal generator. This beat should occur at the 200-Mc mark on the dial scale. If it does not close or open the loop (L7) on the switch until zero beat occurs with the dial set at 200-Mc. Set Figure 20 for the location of L7.

5. Rotate the CALIBRATE selector to "2.5 MC" and note the positions of the beats as the TUNING control is tuned to higher frequencies. If the tracking is correct, the beats will occur at harmonics of 2.5-Mc. If the 230-Mc beat occurs above 230 on the dial scale, decrease the capacity of C33 (see Figure 20 for location) until the beat occurs at the 230-Mc mark. If the beat note occurs below the 230-Mc mark, increase the capacity of C33. In case the 230-Mc beat cannot be made to occur at the 230 mark on the dial scale within the range of adjustment of C33, then set C33 in its mid position and recheck the position of the beat on the dial scale. If the beat occurs above the 230 mark, spread the flat strips connecting the tuning capacitor to the range switch until the beat occurs at the 230 mark on the dial scale. If the beat is below the 230 mark, then squeeze the strips.

6. If it was necessary to change the setting of either the flat strips or C33 in step 5, then repeat steps 4 and 5 until the beat notes occur at the proper dial settings over the range from 200-Mc to 230-Mc.

7. Rotate the RANGE switch to E, and leave the signal generator at the same frequency setting.

8. Turn the CALIBRATE selector to "CRYSTAL OFF", set the TUNING dial on 200, and spread or squeeze coil L6 (see Figure 20 for location) until zero beat is obtained.

9. Set the CALIBRATE selector on "2.5 MC" and rotate the TUNING control while listening to the beat notes. If the alignment of the highest-frequency band is correct, then the beats will occur at harmonics of 2.5-Mc.

10. Turn the RANGE switch to "D", and set the signal generator frequency to 65-Mc.

11. Rotate the RF OUT control counter-clockwise, and tune the signal generator to obtain a zero beat with the 2.5-Mc crystal.

12. Turn the RF OUT control away from its counter-clockwise position and set the TUNING control to 65-Mc.

13. Rotate the CALIBRATE selector to "CRYSTAL OFF", and adjust the core in L5 for zero beat with the signal generator.

14. Rotate the CALIBRATE selector to "2.5 MC", and tune the TUNING control over the band while listening to the beat notes. If the dial does not track properly, adjust C32 (see Figure 20 for location).

15. Repeat steps 13 and 14 until the beats occur at the proper dial settings over the band.

16. Set the RANGE switch to "C" and tune the signal generator exactly to 70-Mc by beating it against the 2.5-Mc oscillator.

17. Rotate the CALIBRATE selector to "CRYSTAL OFF" and set the TUNING control on 70-Mc.

18. Adjust the core in L4 for zero beat with the signal generator.

19. Turn the RANGE switch to "B", rotate the CALIBRATE selector to "2.5 MC", and tune the signal generator 45-Mc by beating it against the 2.5-Mc oscillator.

20. Turn the CALIBRATE selector to "CRYSTAL OFF" and set the TUNING control on 45-Mc.

21. Adjust the core in L3 for zero beat with the signal generator.

22. Turn the RANGE switch to "A", rotate the CALIBRATE selector to "2.5 MC", and tune the signal generator to 30-Mc by beating it against the 2.5-Mc oscillator.

23. Turn the CALIBRATE selector to "CRYSTAL OFF", and set the TUNING control on 30-Mc.

24. Adjust the core in L2 for zero beat with the signal generator.

25. Disconnect the signal generator and rotate the CALIBRATE selector to "2.5 MC".

26. Check the tracking on all bands. If the alignment was performed correctly, and if no circuit fault exists, the tracking should be within the limits given at the start of the section on variable-frequency oscillator alignment.

Notes

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